# Slow Crack Growth Evaluation of Vintage Polyethylene Pipes

**DOT Project No.:** 643
**Contract Number:** DTPH5615T00007

**Reporting Period:** 1st Quarterly Report

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**Prepared For:**
U. S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

**Prepared By:**
Ernest Lever
Principal Investigator
Gas Technology Institute
ernest.lever@gastechnology.org

**Project Manager:**
Andrew Hammerschmidt
Program Director
andrew.hammerschmidt@gastechnology.org

**Subcontractors:**
Arizona State University
University of Colorado-Denver

**Gas Technology Institute (GTI)**
1700 S. Mount Prospect Rd.
Des Plaines, Illinois 60018
www.gastechnology.org

# 1. Objectives

This collaborative program will provide an integrated set of quantitative tools that will provide a structured approach to reducing operational risk in vintage plastic distribution systems susceptible to Slow Crack Growth failures. A novel endoscopic structured light scanning tool will be developed and prototyped for internal inspection of small diameter plastic pipe. The data generated by the tool will be properly reduced to essential parameters to be synthesized with additional available system information including external conditions, inspection and leak records, historic data, and subject matter expertise into a fitness for service evaluation. This assessment will include a probabilistic estimate of the remaining effective lifetime of individual segments of vintage plastic pipe and a yes/no determination of whether a short-term pressure test is capable of validating the maximum defect size in the system. The Bayesian network methods employed are ideally suited to evaluating interacting threats, investigating root causes, and predicting the effect of mitigation strategies based on conditional probabilities calculated from available data.

# 2. Work Completed During Reporting Period

Work in this quarter included:

- Task 1: Probabilistic Decision Support System Design –

- Task 2: Probabilistic Decision Support System Development - Continued developing underlying models – update was provided at the group team meeting at ASU on 3/25/2016. The presentation will be uploaded separately.

- Task 3: Structured Light Scanning Method Development – Continued developing prototypes – update was provided at the group team meeting at ASU on 3/25/2016. The presentation will be uploaded separately.

- Task 4: Bayesian Methods Development – Continued developing underlying models – update was provided at the group team meeting at ASU on 3/25/2016. The presentation will be uploaded separately.

- Task 6: Project Initiation Activities – The Technical Advisory Committee (TAC) was held March 25th in Phoenix, AZ and was hosted by project team member Arizona State University.  An Agenda of the meeting is attached in the Additional Information section of this report.  The following TAC members participated:

  o James Merritt, DOT PHMSA

  o Aaron Forster, PhD, NIST

  o Yongming Liu, PhD, Arizona State University

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- o Yiming Deng, PhD, University of Colorado Denver

- o Ed Newton, Sempra Utilities

- o Andrew Benedict, Opvantek

- o Ernest Lever, Gas Technology Institute

GTI would like to acknowledge and sincerely thank Arizona State University for hosting the first TAC meeting.  There were also changes to participating members of the TAC. The following changes were made due to conflicts in previous member schedules:

- o Brad Pratzer, Enbridge Gas Distribution, replaced Mike Faulkenberry, Avista Utilities.

- o Lance Elroy, Intermountain Gas Utility, replaced Jim Collins, Duke Energy.

## 3. Payable Milestones and Planned Activity

Figure 1 shows the quarterly payable milestones to the end of the project.
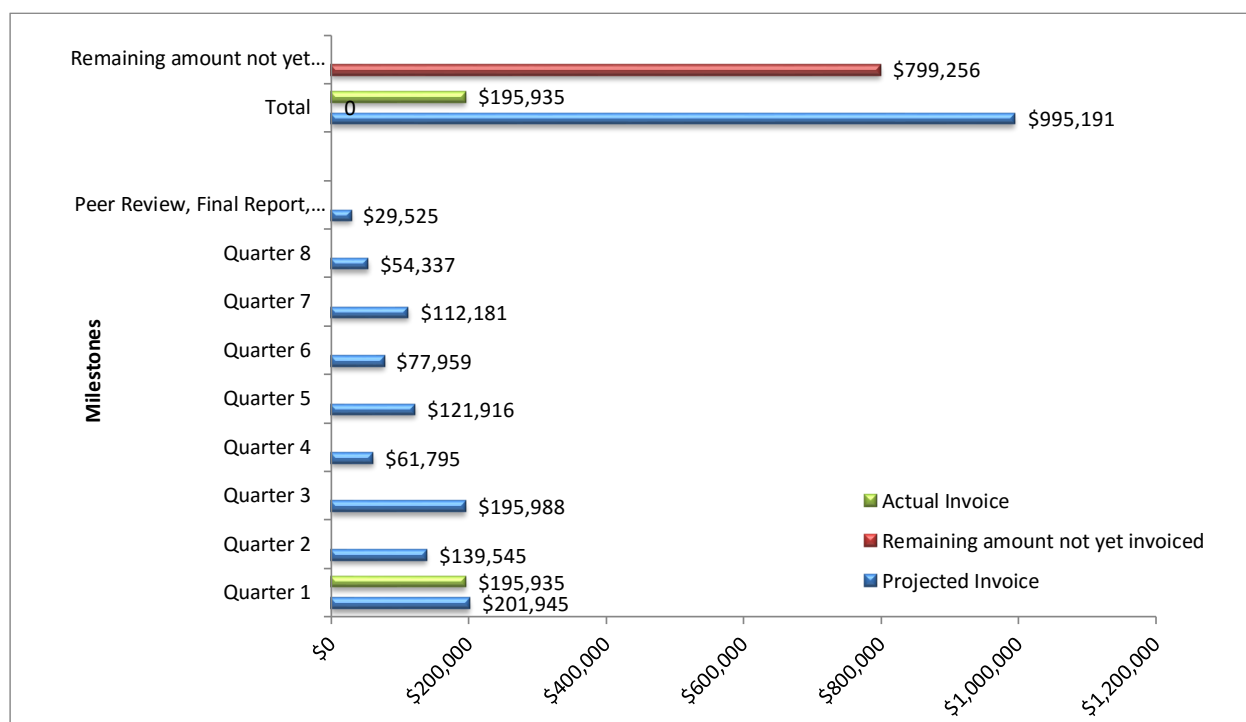
## Plans for Future Activity (Project Quarter #3)

- Task 1: Probabilistic Decision Support System Design –Continue developing system per the milestone schedule. No problems anticipated based on current progress.

- Task 2: Probabilistic Decision Support System Development – Continue developing models per the milestone schedule. No problems anticipated based on current progress.

- Task 3: Structured Light Scanning Method Development – Continue developing prototype per the milestone schedule. No problems anticipated based on current progress.

- Task 4: Bayesian Methods Development – Continue developing methods per the milestone schedule. No problems anticipated based on current progress.

- Task 6: Project Management Activities – Standard project management activities will be performed

## 4. Technical Status

### 4.1 Summary

GTI, Arizona State University, and University of Colorado-Denver made solid technical progress on Tasks 1 through 4, as well as formed the Technical Advisory Committee in Task 6.

Progress to date was presented and discussed at a joint team meeting together with several representatives of the TAC at ASU on March 25th 2016

## 5. Schedule & Issues

Figure 2 shows the time schedule as of 3/31/2016.  No issues were encountered this Quarter. The project remains on schedule.
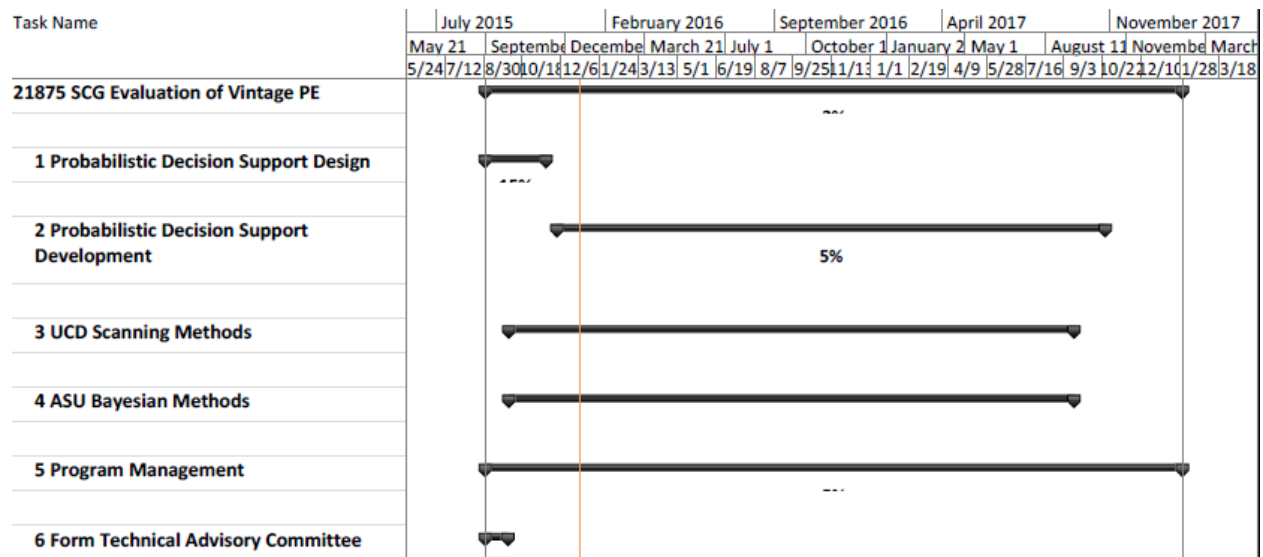
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*Figure 2 - Time schedule by tasks, as of March 31, 2016*

## 6. Budget Status

Expenditure summary through 3/31/2016 (see table note below).  There is no cost share for this project.

| Task | Task Name | Budget | Expense | % Spent | % Complete |
|---|---|---|---|---|---|
| 1 | Probabilistic Decision Support System Design | $150,272 | $78,118 | 52% | 55% |
| 2 | Probabilistic Decision Support System Development | $275,566 | $19,189 | 7% | 9% |
| 3 | Structured Light Scanning Method Development | $197,200 | $0 | 0% | * |
| 4 | Bayesian Methods Development | $208,699 | $0 | 0% | * |
| 5 | Program Management | $157,444 | $11,878 | 8% | 8% |
| 6 | Project Initiation Activities | $6,010 | $7,174 | 119% | 99% |
| | Total | $995,191 | $116,359 | 12% | * |

*As of the date of publishing, subcontractor costs for ASU and UC-D were not available.  This includes expenses for Task 3 and Task 4.  The report will be modified once expenses are available.

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